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(12) **United States Patent**
Miller et al.

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(54) **METHOD AND APPARATUS FOR
ELECTROSPRAY AUGMENTED HIGH
FIELD ASYMMETRIC ION MOBILITY
SPECTROMETRY**

(58) **Field of Search** 250/287, 286,
250/282, 288

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,615,135 A 10/1952 Glenn
2,818,507 A 12/1957 Britten

(Continued)

FOREIGN PATENT DOCUMENTS

SU 966583 A 10/1982
SU 1337934 A2 9/1987

(Continued)

OTHER PUBLICATIONS

"Comparison of the Planar and Coaxial Field Asymmetrical
Waveform Ion Mobility Spectrometer (FAIMS)," Interna-
tional Journal of Mass Spectrometry, 225, (223), pp. 39–51.

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(57) **ABSTRACT**

A field asymmetric ion mobility spectrometer apparatus and system including a sample preparation and introduction section, a head for delivery of ions from a sample, an ion filtering section, an output part, and an electronics part wherein the filter section includes surfaces defining a flow path, further including ion filter electrodes facing each other over the flow path that enables the flow of ions derived from the sample between the electrodes and wherein the electronics part applies controlling signals to the electrodes for generating a filter field for filtering the flow of ions in the flow path while being compensated to pass desired ion species out of the filter.

14 Claims, 33 Drawing Sheets

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(*) **Notice:** Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
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This patent is subject to a terminal dis-
claimer.

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Related U.S. Application Data

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12, 2002, now Pat. No. 6,690,004, which is a continuation-
in-part of application No. 09/358,312, filed on Jul. 21, 1999,
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cation No. 09/439,543, filed on Nov. 12, 1999, now Pat. No.
6,512,224, and a continuation-in-part of application No.
09/799,223, filed on Mar. 5, 2001, now Pat. No. 6,815,668,
and a continuation-in-part of application No. 10/040,974,
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(51) **Int. Cl.**⁷ **B01D 59/44**

(52) **U.S. Cl.** **250/287; 250/286; 250/282;**
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